

**Application No.: 10/561,536**

**REMARKS**

**I. Introduction**

In response to the final Office Action dated June 16, 2008, Applicants have incorporated the limitations of claim 21 into independent claim 1. Claim 21 has been cancelled, without prejudice. No new matter has been added.

For the reasons set forth below, Applicants respectfully submit that all pending claims are patentable over the cited prior art references.

**II. The Rejection Of Claims 1-5 and 22-23 Under 35 U.S.C. § 103**

Claims 1-5 and 22-23 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Thum & Lorenz (Centre of Darmstadt College of Higher Education, pp. 667-673, Vol. 84, No. 26, English Translation) in view of Housh et al. (Selection and Application of Magnesium and Magnesium Alloys," Vol. 2, ASM Handbooks Online) and Hawley's Condensed Chemical Dictionary (14th Ed., revised by Richard Lewis, Sr.), with evidence from Webster's New World Dictionary (3rd College ed., Victoria Neufeldt, Editor); and claim 21 is rejected as being unpatentable over Thum & Lorenz in view of Housh and Hawley's Condensed Chemical Dictionary and further in view of Higgins (Engineering Metallurgy, Part I: Applied Physical Metallurgy, 6th Ed., pp.90-94) and Callister, Jr. (Materials Science & Engineering, An Introduction, 6th Ed.), with evidence from Webster's New World Dictionary.

As the limitations of claim 21 have been incorporated into claim 1, Applicants will address the rejections of claim 21 when referring to claim 1, the sole, non-withdrawn independent claim pending in the application. Applicants respectfully submit that Thum &

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Lorenz, Housh, Hawley's Condensed Chemical Dictionary, Higgins and Callister, Jr. fail to render the pending claims obvious for at least the following reasons.

With regard to the present invention, amended claim 1 recites a magnesium-based alloy screw having a head portion and a thread portion, wherein the screw is formed from a drawn wire made of a magnesium-based alloy, and the wire has an average crystal grain diameter of 10  $\mu\text{m}$  or less, and a maximum crystal grain diameter of 15  $\mu\text{m}$  or less; wherein the tensile strength of the screw is 220 MPa or higher.

One embodiment of the present disclosure teaches a wire that is formed into a screw by drawing a magnesium-based alloy has an average crystal grain diameter of 10  $\mu\text{m}$  or less, and a maximum crystal grain diameter of 15  $\mu\text{m}$  or less. As a result of this feature, a screw having excellent tensile characteristics can be formed, even at temperatures lower than the usual temperature at which magnesium-alloys are worked.

It is admitted in the Office Action that Thum & Lorenz, Housh and Hawley's Condensed Chemical Dictionary all fail to disclose a screw formed from a drawn wire made of a made from a magnesium based alloy which has an average crystal grain diameter of 10  $\mu\text{m}$  or less, and a maximum crystal grain diameter of 15  $\mu\text{m}$  or less. However, it is alleged that Higgins teaches that grain diameter is a result of the degree of deformation imparted to any alloy. As such, it is alleged that achieving the claimed grain size would require only routine optimization of the drawing process by one of ordinary skill and accordingly, would have been obvious to produce an alloy with the claimed grain size. Furthermore, it is also alleged that grain size is a result-effective variable, as taught by Callister, Jr. in which the Hall-Petch relationship shows that the smaller the grain, the stronger the material.

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Applicants respectfully disagree with these allegations. Specifically, Hawleys, Webster's New World Dictionary and Higgins all teach techniques relevant to general metalworking or general metallurgical engineering, not for work with magnesium or magnesium alloys. Thus, techniques disclosed in Hawleys, Webster's New World Dictionary and Higgins are not applicable to Thum & Lorenz and Housh, which are admittedly silent with regard to grain crystal size.

Furthermore, although Callister, Jr. shows that the small grain size provides for stronger material, it is also well known that plastic workability of magnesium and its alloy is extremely poor at low temperature (i.e., room temperature) due to the hexagonal close-packed lattice structure, as described in paragraph [0003] of the present application. For this reason, magnesium-based alloys are conventionally worked at temperatures in which the plastic workability increases (i.e., 250 °C or higher, see, Housh p. 1, 2nd paragraph and paragraph [0006] of the present specification). However, when working at this temperature, the grain structure becomes coarse. As such, one skilled in the art would not achieve a uniform and fine structure of a drawn material with the claimed crystal grain diameter by using conventional techniques as described in the prior art.

In contrast, the wire of the present disclosure made from magnesium-based alloy which forms a magnesium-based alloy screw is obtained by a specific drawing and thereby has the average crystal grain diameter of 10  $\mu\text{m}$  or less, and a maximum crystal grain diameter of 15  $\mu\text{m}$  or less. The specific drawing is disclosed in paragraphs [0014] and [0039] of the specification. By fining down the alloy structure of a wire made of a magnesium-based alloy, plastic workability can be enhanced even at a temperature of less than 250 °C. As such, as it has not been shown in the Office Action that any of the cited prior art discloses a drawn magnesium wire

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having the claimed range of crystal grain diameter, and as the above arguments show that it would not be obvious to one skilled in the art that such a crystal grain diameter is obtainable through the techniques described in the cited prior art, Applicants submit that the cited prior art fails to render amended claim 1 obvious.

Therefore, as is well known, in order to establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. As Thum & Lorenz, Housh, Hawley's Condensed Chemical Dictionary, Higgins and Callister, Jr. do not disclose a magnesium-based alloy screw formed from a drawn wire made of a made from a magnesium based alloy which has an average crystal grain diameter of 10  $\mu$ m or less, and a maximum crystal grain diameter of 15  $\mu$ m or less, it is apparent that Thum & Lorenz, Housh, Hawley's Condensed Chemical Dictionary, Higgins and Callister, Jr. fails to render amended claim 1 or any dependent claims thereon obvious. Accordingly, the Applicants respectfully request that the § 103 rejection be traversed.

**III. All Dependent Claims Are Allowable Because The Independent Claim From Which They Depend Is Allowable**

Under Federal Circuit guidelines, a dependent claim is nonobvious if the independent claim upon which it depends is allowable because all the limitations of the independent claim are contained in the dependent claims, *Hartness International Inc. v. Simplimatic Engineering Co.*, 819 F.2d at 1100, 1108 (Fed. Cir. 1987). Accordingly, as amended claim 1 is patentable for the reasons set forth above, it is respectfully submitted that all pending dependent claims are also in condition for allowance.

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**IV. Conclusion**

Having responded to all open issues set forth in the Office Action, it is respectfully submitted that all claims are in condition for allowance.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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